3.3

→ $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ $\quad f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$

→ Graph derivative from graph of original function and vice versa

→ tangent lines & normal lines

→ derivatives don't exist (cusp, corner, discontinuities, jump, inf., etc. vert. tangent)

→ Differentiability implies continuity and local linearity

→ intermediate value Thm. for derivatives $f'(a) = -2 \quad f'(b) = 5$

$f'(x)$ takes on all values between -2 & 5 on interval $[a, b]$

→ implicit differentiation

→ higher order derivatives

→ $f(x)$ = dist. $\quad f'(x)$ = vel. $\quad f''(x)$ = accel

→ ALL THE RULES

6. If $x^2 + xy = 10$, then when $x = 2$, $\frac{dy}{dx}$ $\Rightarrow 2x + x\frac{dy}{dx} + y = 0$ $\quad \frac{dy}{dx} = -\frac{y-2x}{x}$

$y = 3$

(A) $-\frac{7}{2}$ (B) -2 (C) $\frac{2}{7}$ (D) $\frac{3}{2}$ (E) $\frac{7}{2}$

---

8. Let f and g be differentiable functions with the following properties:

(i) $g(x) > 0$ for all x

(ii) $f(0) = 1$

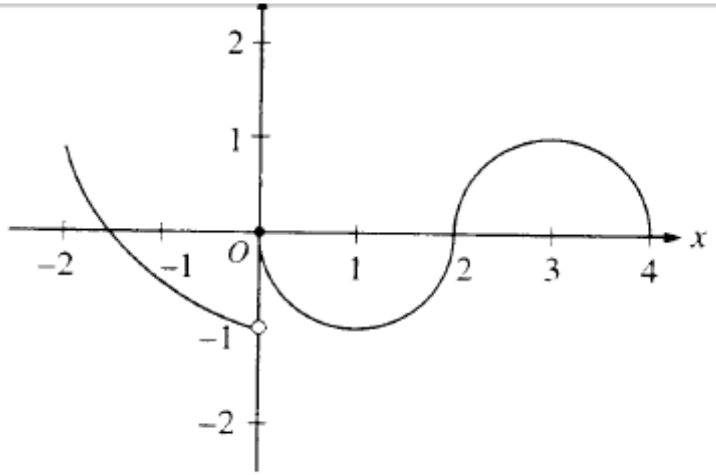
$h'(x) = f(x)g'(x) + g(x)f'(x)$ $\quad \downarrow \quad 0$

If $h(x) = f(x)g(x)$ and $h'(x) = f(x)g'(x)$, then $f(x) =$

(A) $f'(x)$ (B) $g(x)$ (C) e^x (D) 0 (E) 1

10. What is the instantaneous rate of change at $x = 2$ of the function f given by $f(x) = \frac{x^2 - 2}{x - 1}$?

(A) -2 (B) $\frac{1}{6}$ (C) $\frac{1}{2}$ (D) 2 (E) 6



13. The graph of the function f shown in the figure above has a vertical tangent at the point $(2,0)$ and horizontal tangents at the points $(1,-1)$ and $(3,1)$. For what values of x, $-2 < x < 4$, is f not differentiable?

(A) 0 only (B) 0 and 2 only (C) 1 and 3 only (D) 0, 1, and 3 only (E) 0, 1, 2, and 3

---

14. A particle moves along the x-axis so that its position at time t is given by $x(t) = t^2 - 6t + 5$. For what value of t is the velocity of the particle zero?

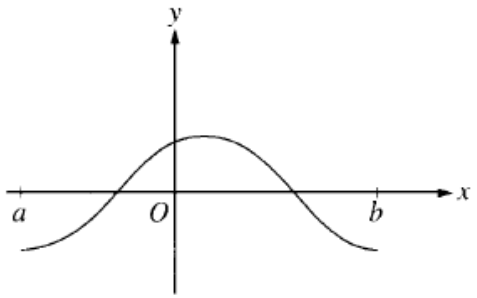
$v(t) = 2t - 6$

(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

---

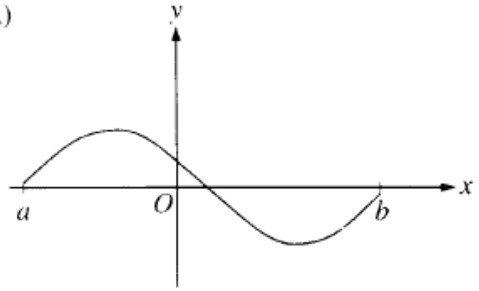
18. An equation of the line tangent to the graph of $y = x + \cos x$ at the point $(0,1)$ is

(A) $y = 2x + 1$ (B) $y = x + 1$ (C) $y = x$ (D) $y = x - 1$ (E) $y = 0$

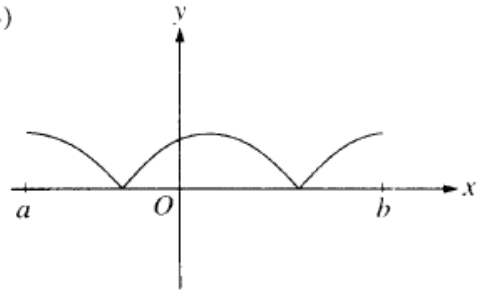


23. The graph of f is shown in the figure above. Which of the following could be the graph of the derivative of f?

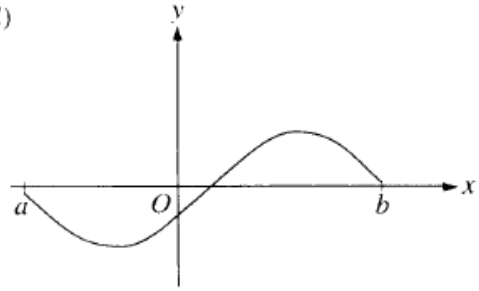
(A)



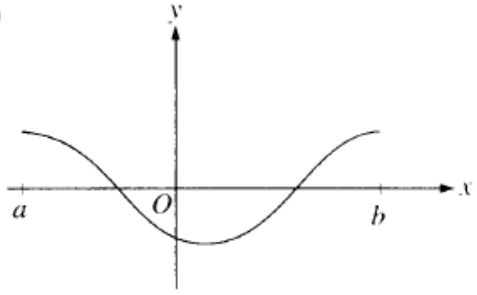
(B)



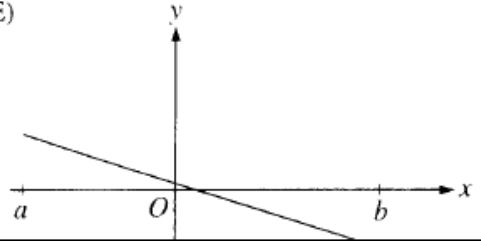
(C)



(D)



(E)



24. The maximum acceleration attained on the interval $0 \le t \le 3$ by the particle whose velocity is given by $v(t) = t^3 - 3t^2 + 12t + 4$ is

(A) 9 (B) 12 (C) 14 (D) 21 (E) 40

28. If $f(x) = \tan(2x)$, then $f'\left(\frac{\pi}{6}\right) =$

(A) $\sqrt{3}$ (B) $2\sqrt{3}$ (C) 4 (D) $4\sqrt{3}$ (E) 8

77. Let f be the function given by $f(x) = 3e^{2x}$ and let g be the function given by $g(x) = 6x^3$. At what value of x do the graphs of f and g have parallel tangent lines?

(A) –0.701
(B) –0.567
(C) –0.391
(D) –0.302
(E) –0.258

use calculator on these three

83. If $a \neq 0$, then $\lim_{x \to a} \dfrac{x^2 - a^2}{x^4 - a^4}$ is

(A) $\dfrac{1}{a^2}$ (B) $\dfrac{1}{2a^2}$ (C) $\dfrac{1}{6a^2}$ (D) 0 (E) nonexistent

87. Which of the following is an equation of the line tangent to the graph of $f(x) = x^4 + 2x^2$ at the point where $f'(x) = 1$?

(A) $y = 8x - 5$
(B) $y = x + 7$
(C) $y = x + 0.763$
(D) $y = x - 0.122$
(E) $y = x - 2.146$

p.132 #6 [A] - implicit differentiation

#8 [E] - product rule

#10 [D] - instantaneous rate of change given eq.

#13 [B] - Differentiability

#14 [C] - Partical moving, find vel = 0

#18 [B] - tangent line

#23 [A] - graph of f'(x) given f(x)

#24 [D] - Accel given vel

#28 [E] - deriv. of $\tan 2x$ at $\frac{\pi}{6}$

p.139 Calc. Required

#77 [C] - parallel tangent lines - two graphs

#83 [B] - limit at a point def.

#87 [D] - tagent line